9450

PH. SCHUSTER, PAPIERHANDLUNG

I. V. S. 1892/93

Dr. Emil Weyr

Analytische Geometrie des Raumes

M Smoluchowski

Wien, Wieden Hauptstrasse 55.

[illegible]

17/10

P' P'' P''' = orthog. Proj.

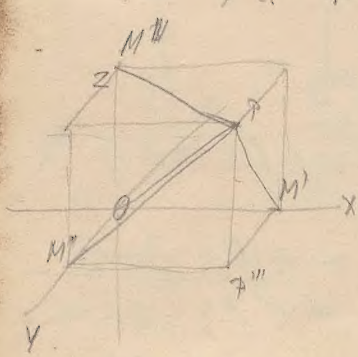
[illegible]

8 Octanten [illegible]

+ x	+ y	+ z	[illegible] X Y
+	–	+	
–	+	+	
–	–	+	
+	+	–	[illegible]
+	–	–	
–	+	–	
–	–	–	

$x = a$
$y = b$
$z = c$ [illegible]

[illegible] const. [illegible]



$OM' = P'P = x$

etc.

[illegible] $OP = \sqrt{[illegible]} = r$

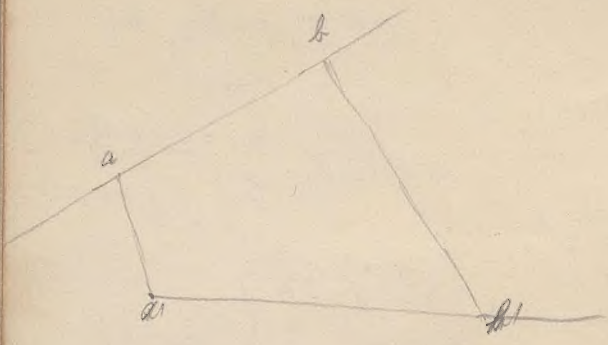
$PM' \perp X$ [illegible]

$PM'' \perp Y$

$PM''' \perp Z$

Projection einer Geraden auf eine andere

Proj. [illegible]



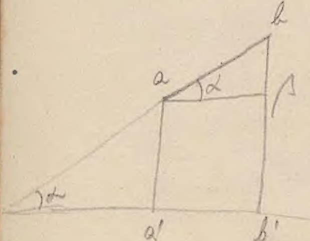
x = Proj. r [illegible] $\mathcal{X}$

y = Proj. r [illegible] Y

z = " [illegible] Z

BH.

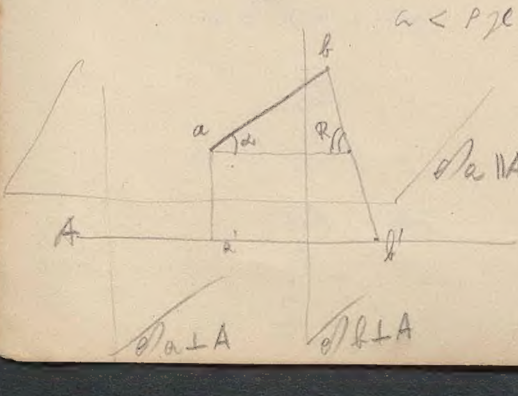
$\overline{a'b'} = \overline{ab}\cos\alpha$ [illegible]



$a'b' = a\beta = ab\cos\alpha$

Proj.ax

[illegible]

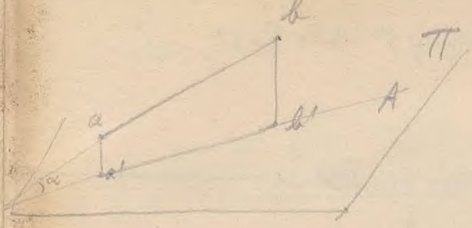


[illegible]

$a'b' = ab\cos\alpha$

[illegible]

[illegible]



[illegible] Π [illegible]

$\text{proj.}\ \overline{ab} = \overline{ab}\cos\alpha$

$\sphericalangle XOP = \alpha$

$\sphericalangle YOP = \beta$

$\sphericalangle ZOP = \gamma$

$\sphericalangle$ [illegible]

$x = r\cos\alpha$

$y = r\cos\beta$

$z = r\cos\gamma$

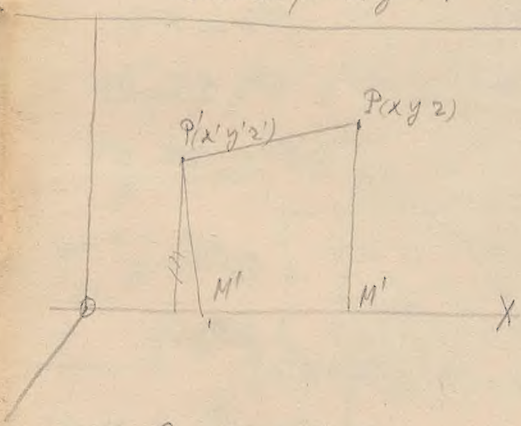
$r^2 = OM'^2 + M'P^2 = OM'^2 + P'''P^2 + M'P'''^2$

$= OM'^2 + OM'''^2 + OM''^2$

$r^2 = x^2 + y^2 + z^2$

$r^2 = r^2[\cos^2\alpha + \cos^2\beta + \cos^2\gamma]$

$\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$



$\overline{P'P} = e$

$PM' \perp X$

$PM'_1 \perp X$

$OM' = x$

$OM'_1 = x'$

$\overline{M'_1 M'} = x - x'$

$= \text{Proj.}\ P'P$

$\alpha, \beta, \gamma = \sphericalangle$ [illegible] $[\nu \wedge \Pi]$

$x - x' = \text{Proj.}\ e$ [illegible] X [illegible]

$y - y' = \text{Proj.}\ e$ Y

$z - z' =$ Z

$x-x' = e\cos\alpha$

$y-y' = e\cos\beta$

$z-z' = e\cos\gamma$

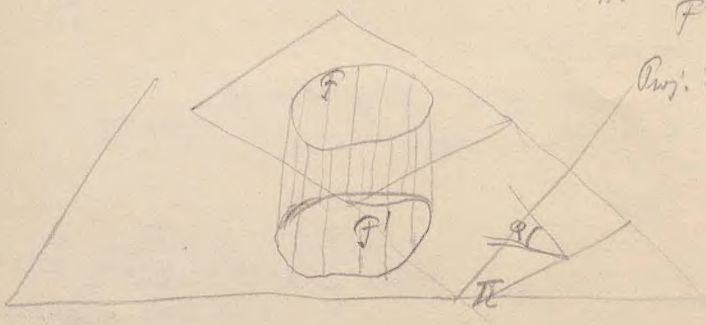
$$(x-x')^2+(y-y')^2+(z-z')^2=e^2$$

Projektion von Flächen

[illegible]

BH: $F' = F\cos\varphi$

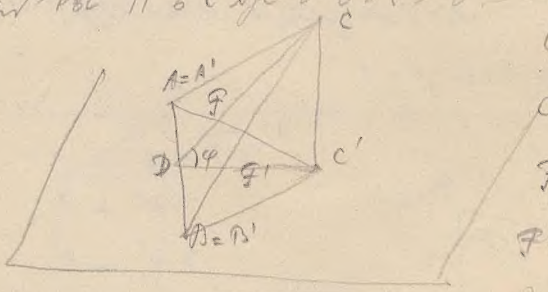
Proj. $F = F\cos\varphi$



[illegible]

[illegible]

[illegible] π [illegible]

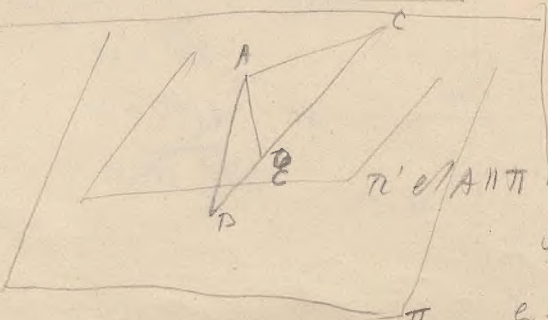


$CD \perp AB$

$C'D \perp AB$

$$F = \frac{AB \cdot CD}{2}$$

$$F' = \frac{AB \cdot C'D}{2} = \frac{AB \cdot CD\cos\varphi}{2} = F\cos\varphi$$

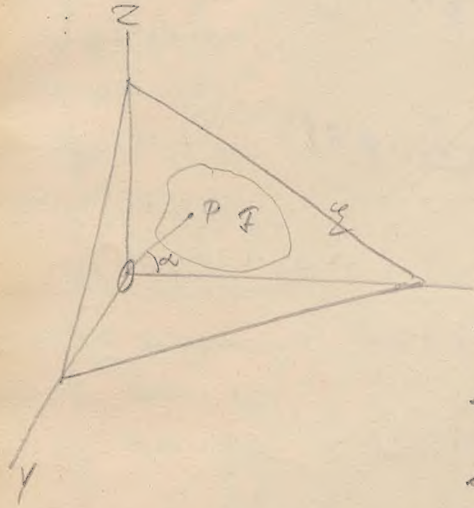


π' d. A ∥ π

[illegible]

[illegible] Σ

[illegible]



[illegible] Samstr.

[illegible]:

$OP \perp$ Eb. $\mathfrak{E}$ ~~XYZ~~

$\sphericalangle \alpha = \sphericalangle \mathfrak{E}, YOZ$

$\sphericalangle \beta = \widehat{\mathfrak{E}\ XOZ}$

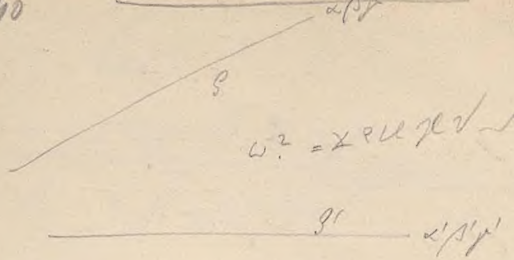
$\sphericalangle \gamma = \widehat{\mathfrak{E}\ XOY}$

— [illegible] 3 C.Z

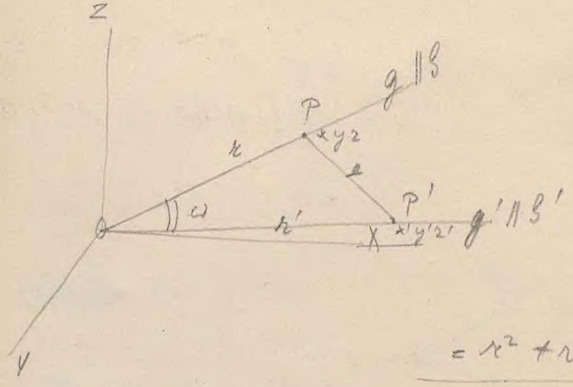
F_{xy}, F_{xz}, F_{yz}

$$\left.\begin{aligned} F_{yz} &= F\cos\alpha \\ F_{xz} &= F\cos\beta \\ F_{xy} &= F\cos\gamma \end{aligned}\right\} \quad (F_{yz})^2 + (F_{xz})^2 + (F_{xy})^2 = F^2$$

19/10 Winkel zweier Geraden



$\omega^2 =$ [illegible]



$$e^2 = r^2 + r'^2 - 2rr'\cos\omega$$
$$= (x-x')^2 + (y-y')^2 + (z-z')^2$$
$$= x^2+y^2+z^2 - 2xx' - 2yy' - 2zz' + x'^2 + y'^2 + z'^2$$
$$= r^2 + r'^2 - 2(xx'+yy'+zz')$$

$$rr'\cos\omega = xx' + yy' + zz'$$

$x = r\cos\alpha$	$x' = r'\cos\alpha'$
$y = r\cos\beta$	$y' = r'\cos\beta'$
$z = r\cos\gamma$	$z' = r'\cos\gamma'$

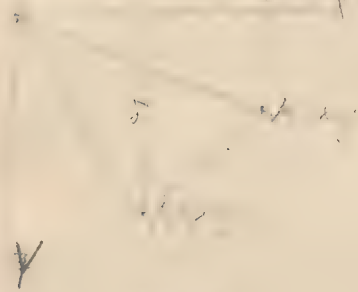
$$\cos\omega = \cos\alpha\cos\alpha' + \cos\beta\cos\beta' + \cos\gamma\cos\gamma'$$

[illegible] $r = r' = 1$ [illegible]

Bsp:

$g' \perp g$ $\quad \cos\alpha\cos\alpha' + \cos\beta\cos\beta' + \cos\gamma\cos\gamma' = 0$

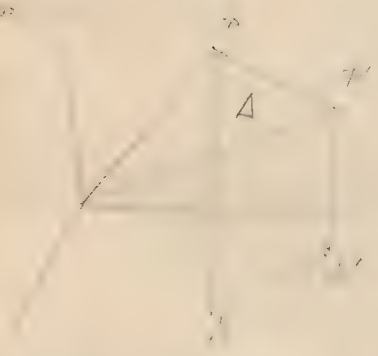
$$\cos\omega = \cos\alpha\cos\alpha' + \cos\beta\cos\beta' + \cos\gamma\cos\gamma'$$
$$\sin^2\omega = 1 - [\cos\alpha\cos\alpha' + \cos\beta\cos\beta' + \cos\gamma\cos\gamma']^2$$
$$= [\cos^2\alpha + \cos^2\beta + \cos^2\gamma][\cos^2\alpha' + \cos^2\beta' + \cos^2\gamma'] -$$
$$- [\cos\alpha\cos\alpha' + \cos\beta\cos\beta' + \cos\gamma\cos\gamma']^2$$
$$= [\cos\alpha\cos\beta' - \cos\beta\cos\alpha']^2 + [\cos\beta\cos\gamma' - \cos\gamma\cos\beta']^2 +$$



$\delta = \frac{y+y'}{2}(x - x') + \frac{x'y'}{2} - \frac{xy}{2}$ [illegible]

$= \frac{1}{2}[$ [illegible] $]$

$= \frac{1}{2}[$ [illegible] $]$



$\Delta = \frac{1}{2}$ [illegible]

$\Delta^2 = \frac{1}{4}\{[$ [illegible] $\}$ [illegible]

etc.

$6V = $ [illegible]

[illegible]

$N \perp OP_1$ [illegible]

$N \perp OP$ $\qquad 6V = $ [illegible]

[illegible] ψ

$\cos\psi = $ [illegible]

[illegible]

$ON \perp OP_1$: [illegible]

$ON \perp OP_2$: [illegible]

[illegible] -1

[illegible] $\alpha_2 - $ [illegible] $\alpha\,] = 0$

[illegible] $=$ [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

$= [illegible]$

[illegible]

$d = \lambda^2 \sin^2 [illegible]$ $\quad 1 = \frac{[illegible]}{[illegible]}$

[illegible]

[illegible]

[illegible]

[illegible]

$+ z_3 (x_1$

$+ z_2 (x_3$

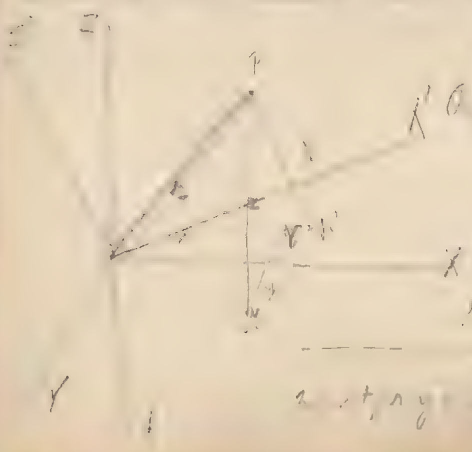
$1 - Tr$

$z = z'$

$x = x'$

[illegible]

$\delta P = 0$, $P = 0$ $\Delta = 0$



[illegible]

$= \frac{1}{2}\, \Sigma\, YY$ [illegible]

$= \frac{1}{2}\, XX$ [illegible]

$= \frac{1}{2}\, \Sigma XY$ [illegible]

[illegible]

[illegible]

[illegible]

X' [illegible]

Y' [illegible]

Z' [illegible]

$\Sigma\, X$ [illegible] $x = x'$ [illegible] $+ y'$ [illegible] $+ z'$ [illegible]

$\Sigma\, Y$ [illegible] $y =$ [illegible]

$\Sigma\, Z$ [illegible] $z =$ [illegible]

[illegible]

$\frac{x}{X'} = \frac{y}{Y'} = \frac{z}{Z'}$ [illegible]

$x' = x\cos\alpha_1 + y\cos\beta_1 + z\cos\gamma_1$ [illegible]

$y' = x\cos\alpha_2 + y\cos\beta_2 + z\cos\gamma_2$ [illegible]

$z' = x\cos\alpha_3 + y\cos\beta_3 + z\cos\gamma_3$ [illegible]

$x\cos\alpha_1 + y\cos\beta_1 + z\cos\gamma_1 =$ [illegible] $+$

$+\ y'(\cos\alpha_2$ [illegible] $+$

$+\ z'(\cos\alpha_3$ [illegible] $= 0$

$x =$ [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] Σ [illegible]

$x = a$ [illegible] Σ [illegible]

[illegible]

[illegible]

[illegible] Σ [illegible]

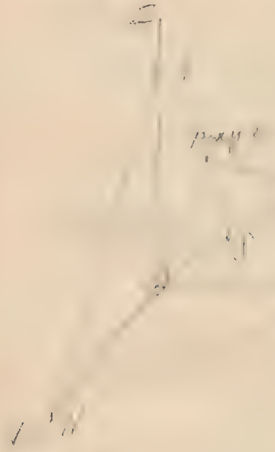
$x = a$

$y = b$ [illegible]

$z = c$

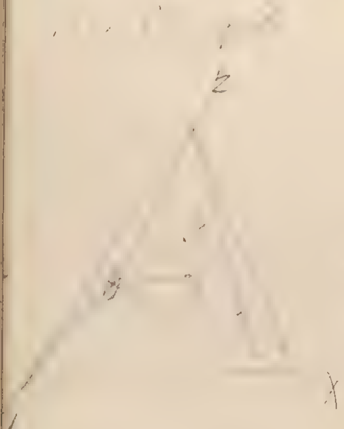
[illegible]

[illegible]



$OO' = 2p$

$2p \cos\alpha \cdot x + 2p \cos\beta \cdot y + 2p \cos\gamma \cdot z = \frac{4p^2}{2}$


Z
X


X

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

λ [illegible] $= 1$

$\dfrac{1}{[illegible]}$

$Ax + Cz + D = 0 \quad \parallel OY$

$Ax + \dots \quad \perp Z$

$Ax + By + Cz = 0$

$$\lambda \cdot D = 0$$

$$\lambda = \frac{D'}{D} \qquad D = 0$$

$$1 = 0$$

[illegible]

p_1 [illegible]

[illegible]

$\pi = \frac{1}{2}\pi$ [illegible] T_1 x [illegible]

x_1 [illegible]

$p' = x_1$ [illegible]

$V_1 J_1 = p - (x_1$ [illegible] $y)$

$= -[x_1$ [illegible]$]$

[illegible] $= 0$ [illegible]

[illegible]

[illegible] $V_1 F_1$ [illegible]

[illegible] B_1 [illegible]

$\lambda = \frac{[illegible]}{[illegible]}$ $\frac{A_1 [illegible] B_u [illegible] C_u [illegible]}{[illegible]}$

[illegible]

[illegible]

[illegible] $=$ [illegible]

[illegible] Π [illegible]

[illegible]

Π [illegible]

[illegible]

$p\,l' = -[$[illegible]$]$

$p\,l' = -[$[illegible]$]$

[illegible]

[illegible]

[illegible]

Π : [illegible]

$n \equiv$ [illegible]

[illegible] $p' \equiv n'$

[illegible] : $n - k\, n' = 0$

[illegible]

[illegible] : $n - k\, n' = 0$

$\pi + k\, n' = 0$

[illegible]

[illegible]

$\gamma - K$ [illegible]

$K = k$ [illegible]

$\gamma = 0$ [illegible]

[illegible] 3 [illegible] $\frac{1}{2}$

[illegible]

$F_1 = 0$ m

$F_2 = 0$ n

$F_3 = 0$

$F_4 = 0$

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] $= u_1$

[illegible] $\perp$ [illegible] $= u_2$

[illegible] $= u_3$

[illegible]

$u_i = -\frac{[illegible]}{[illegible]} = $ [illegible]

[illegible]

[illegible] $<$

[illegible]

[[illegible]]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

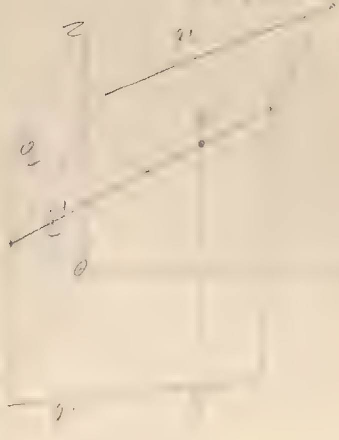
[illegible] $Y \supset Z$

$Z \supset X$

[illegible] $X \supset Y$

[illegible]

[illegible]



$2 = \ell x + n$

$z = c y +$

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] $= 2$

[illegible]

[illegible]

[illegible]

[illegible]

$D =$ [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

A [illegible]

[illegible] $A($[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] $= 0$

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

$[illegible] = t$

[illegible] t [illegible]

[illegible]

$= -\frac{1}{2}$

$x = \frac{\frac{x_1 + x_2}{2} - \frac{1}{2} x_3}{1 - \frac{1}{2}} = \frac{x_1 + x_2 + x_3}{3}$

[illegible]

[illegible] $=$ [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

$x_1 -$ [illegible]

$x = y_1$ [illegible] $- f' x_3 =$ [illegible]

$x = m_1 x_1 +$ [illegible]

$y = m_1 y_1 +$ [illegible]

$z = m_1 z_1 +$ [illegible]

[illegible]

$Ax + By + Cz + D = 0$ [illegible]

$y = ax + $ [illegible]

$z = bx + n$

a

[illegible]

$$\cos = \frac{Aa + Bb + Cc}{\sqrt{A^2 + B^2 + C^2}\sqrt{1 + a^2 + b^2}}$$

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

A [illegible]

A [illegible]

$A + B$ [illegible]

[illegible]

$A :$ [illegible]

$\therefore B$ [illegible]

$x - x'$ [illegible] $+$ [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

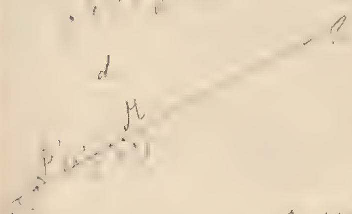
$z = k x - m$

[illegible]

$A \ldots - \ldots + C\lambda = 0$

$\lambda = \frac{A\alpha - C}{\ldots - C}$

[illegible]



$\frac{x - x'}{A} = \frac{y - y'}{\ldots} = \ldots$

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

$x = $ [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

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[illegible]

[illegible]

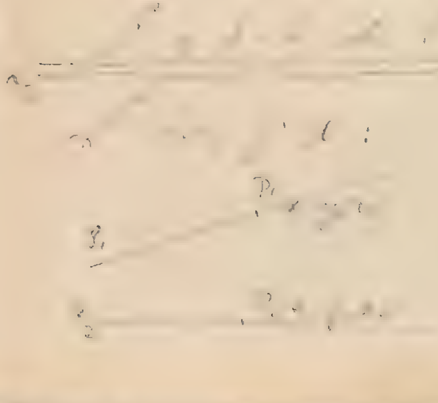
[illegible] $= 0$

[illegible]

[illegible]

[illegible]

[illegible]



[illegible] $= k$

[illegible]

$\varphi_1 -$ [illegible] $= 0$

$\varphi_2 -$ [illegible] $(x - x_1)$ [illegible] $= 0$

$p_1 =$ [illegible]

$p_2 =$ [illegible]

$k = (x - x_1)\cos$ [illegible] $(y - y_1)$ [illegible]

$k = (x -$ [illegible] $)[$ [illegible] $] +$

$+ (y -$ [illegible] $)[$ [illegible] $]$

$+ (z_1 -$ [illegible] $)[$ [illegible] $]$

$\sqrt{(\cos$ [illegible] $)^2 +$ [illegible] $)^2 +}$ [illegible]

[illegible] !!!

[illegible]

[illegible]

[illegible]

[illegible] k [illegible]

[illegible]

[illegible]

[illegible]

[illegible] k [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] 1 [illegible]

1 [illegible]

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[illegible]

$P_i =$ [illegible]

[illegible]

[illegible] $t =$ [illegible]

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[illegible]

[illegible]

[illegible]

[illegible] $1 = I$ [illegible] $= 1$

3 [illegible] $= 1$

[illegible] $\Big\}$ $\lambda = 0$

[illegible] 5 [illegible] 6 [illegible]

[illegible] $\lambda_0 +$ [illegible]

[illegible] 8 [illegible]

[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]
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[illegible]

P_1 [illegible]

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[illegible]

[illegible]

[illegible]

[illegible] $= 0$

[illegible]

[illegible]

[illegible]

[illegible]

$x =$ [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

$z =$ [illegible]

[illegible]

$u\,x + v\,y =$ [illegible]

x [illegible]

[illegible]

[illegible]

$\varphi = P =$

$u\,x + v\,y +$ [illegible]

[illegible]

[illegible]

u [illegible]

[illegible]

u [illegible]

[illegible]

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I

2

1

[illegible] $= \frac{c}{m}$

1. I

$\varphi_1 = 0$

2. I $\quad \varphi_2' = 0$

3. III

$A(x_1 - \lambda x_2) + \dots$

$\varphi_1 - \lambda \varphi_2 - \lambda \left[\varphi_1' - \lambda \varphi_2'\right] \dots$

$-\lambda \varphi_2 - \lambda \varphi_1' = 0$

$\lambda \varphi_2 + \varphi_1' = 0$

4. IV

$m \varphi_2 + n \varphi_1' = 0$

$$\frac{\varphi_2}{\varphi_1'} = -\frac{1}{\lambda} = -\frac{n}{m}$$

[illegible]

[illegible]

[illegible]

[illegible] } [illegible]

[illegible]

[illegible]

F [illegible]

[illegible]

[illegible]

F [illegible]

[illegible]

[illegible]

[illegible]

F [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

IV [illegible]

[illegible]

$y - 14 = 0$

[illegible]

[illegible]

[illegible]

[illegible]

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$F(x, y, z, w) =$ [illegible]

[illegible]

$\frac{\partial F}{\partial x} =$ [illegible]

$\frac{\partial F}{\partial y} =$ [illegible]

[illegible]

[illegible]

$x \frac{\partial F}{\partial y} - y \frac{\partial F}{\partial x}$ [illegible]

[illegible]

$\frac{\partial F}{\partial x}$ [illegible] $\frac{\partial F}{\partial y}$ [illegible]

[illegible]

$x \frac{\partial F}{\partial y} + y \frac{\partial F}{\partial x}$ [illegible]

[illegible]

[illegible]

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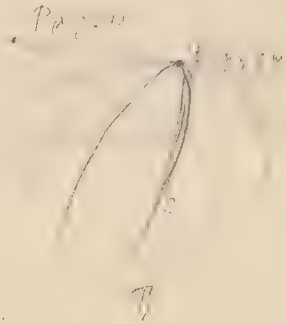

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$A =$ [illegible]

[illegible]

$I =$ [illegible]

$T.$ [illegible]

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[illegible] [illegible]

[illegible] [illegible]

[illegible] [illegible]

[illegible] [illegible]

[illegible]

$$\begin{vmatrix} [illegible] \end{vmatrix} = 0$$

PH. SCHUSTER, PAPIERHANDLUNG

II. V. S. 1892/93

Dr. Emil Weyr

Analytische Geometrie des Raumes

M. Smoluchowski

Wien, Wieden Hauptstrasse 55.

[illegible]

$= A$ [illegible] $+$ [illegible]

$A \ldots =$

$= A$

$A = A^3$

$= A A_1$

$A = A^3$

$\frac{A_1}{[illegible]}$ [illegible] $\frac{A_{[illegible]}}{[illegible]} = \frac{A}{A^{[illegible]}}$

[illegible]

$A_{[illegible]}$ [illegible]

$a = \frac{A_{[illegible]}}{A^{[illegible]}}$

F[illegible]

[illegible]

[illegible]

W[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

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[illegible]

[illegible]

[illegible]

[illegible] $x^2 +$ [illegible] $+$

[illegible]

[illegible] ≥ 0 [illegible] $\Delta =$ [illegible]

$a'_{44} = \ldots$ [illegible]

[illegible]

$a'_{44} = a_{44} + \ldots$ [illegible]

$\xi = \frac{\Delta_1}{\Delta_{44}}$ [illegible]

$a'_{44} = \frac{a_{44}\,\Delta_{44} \ldots}{\Delta_{44}}$

$a'_{44} = \frac{\Delta}{\Delta_{44}}$

$a_{11}x^2 + a_{22}y^2 + a_{33}z^2 + 2a_{12}xy + \ldots$ [illegible]

$+\frac{\Delta}{\Delta_{44}} = 0$ [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

$\perp$ [illegible]

[illegible]

[illegible]

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[illegible]

[illegible]

[illegible]

[illegible] a'_{13} [illegible]

[illegible] $a'_{11} +$ [illegible] $+$ [illegible]

[illegible] a'_{11} [illegible] $+$ [illegible] $= a_{11}$ [illegible]

[illegible]

[illegible] $= a_{11}$ [illegible]

[illegible] a'_{11} [illegible]

[illegible] $- a_{11} +$ [illegible] $+$ [illegible]

[illegible] $- a_{21}^2$ [illegible] $u - (a_{11}$ [illegible] $+$ [illegible] $) = 0$

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

$a_{11}\, a_{22}$ [illegible]

[illegible]

$\Rightarrow$ [illegible]

[illegible]

V [illegible]

[illegible]

[illegible]

[illegible]

[illegible] $\Big]^2 > 0$

[illegible]

$V = -$ [illegible]

[illegible] $>$ [illegible]

[illegible]

[illegible] $\Big]^2 < 0$

[illegible]

[illegible]

[illegible] $=$ [illegible] $= \delta$

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

VI. [illegible] V. [illegible]

V/. [illegible] $= 1$ [illegible]

[illegible] $= -\frac{1}{[illegible]}$

I. [illegible]

$\frac{x^2}{[illegible]} + \frac{[illegible]}{[illegible]} + \frac{[illegible]}{[illegible]} = 1$

$\frac{x^2}{[illegible]} + \frac{[illegible]}{[illegible]} + \frac{[illegible]}{[illegible]} = 1$ [illegible]

I. [illegible]

$\frac{x^2}{[illegible]} + \frac{y^2}{[illegible]} - \frac{[illegible]}{[illegible]} =$ [illegible]

[illegible] $= 1$ [illegible] /

[illegible]

[illegible] [illegible]

[illegible]

[illegible]

[illegible] $= 0$ [illegible]

[illegible]

[illegible] [illegible]

[illegible] [illegible]

7 [illegible]

[illegible]

[illegible]

[illegible]

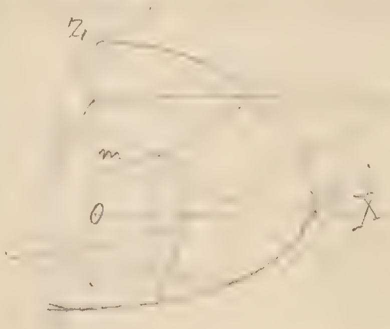
[illegible] [illegible]

[illegible]

[illegible] [illegible]

$\frac{1}{r_1} \leqq \frac{1}{r_2}$

$r_1 \geqq r_2$



$\frac{x^2}{a^2} \ldots$

$\frac{y^2}{b^2} \ldots$

$\ldots = 1$

[illegible]

[illegible]

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[illegible]

[illegible]

[illegible]

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[illegible]

$m > 0$

$A_1 = 0$

F

F'

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[illegible] + [illegible] + [illegible] + [illegible]

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$\Delta =$ [illegible]

[illegible]

$\Delta' =$ [illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible] 12 11 [illegible] 32 [illegible]

[illegible]

[illegible] 20 [illegible]

[illegible] = δ

$\delta =$

$= 1$

$A' = \Delta$

$$\begin{vmatrix} 0 & & & \\ 0 & & & -c \\ 0 & & -c & \end{vmatrix} = -\ldots c^2 = \Delta$$

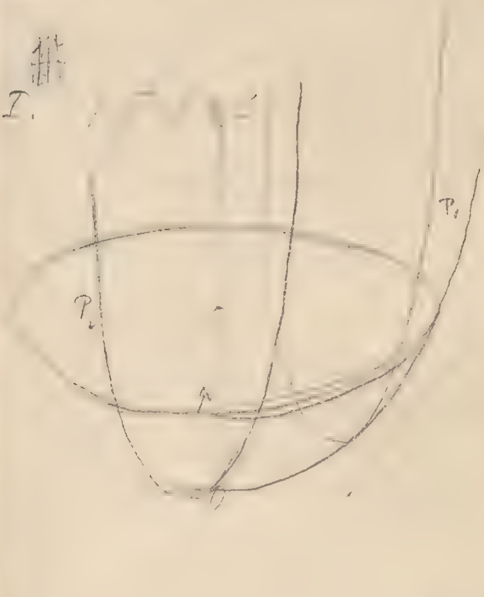
$\ldots = 2$

$\ldots + 2 \ldots = -2$

I.

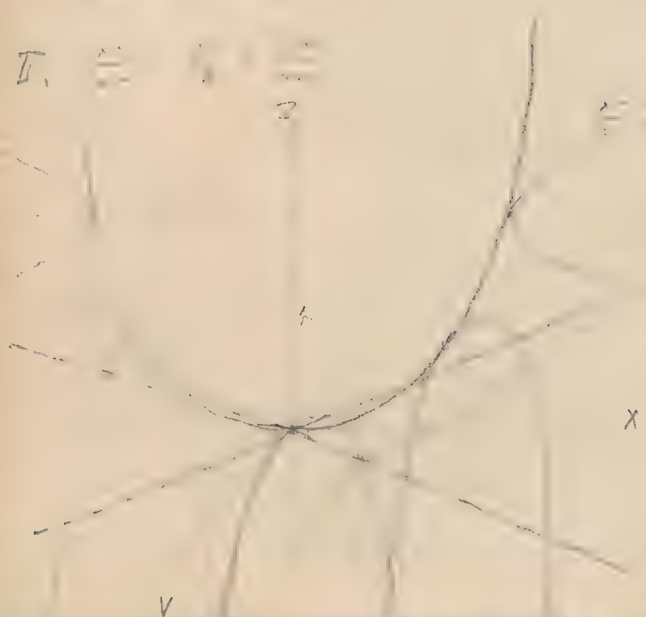
II.

I.



X

Y


X
Y

[illegible]

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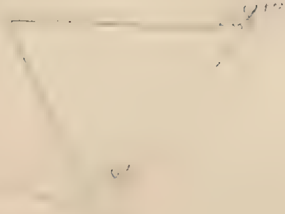

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1/6 [illegible]

[illegible]

[illegible] $= 1$

[illegible]

[illegible]

$\Delta =$ [illegible]

[illegible]

[illegible] θ [illegible]

[illegible] $OP = 3$ [illegible]

11/6

[illegible]

[illegible]

$$\frac{1}{[illegible]} = [illegible]$$

$$\frac{1}{[illegible]} \frac{1}{[illegible]} = \frac{[illegible]}{[illegible]} + \frac{[illegible]}{[illegible]} + \frac{[illegible]}{[illegible]}$$

$$\frac{1}{u^4} - \left[\frac{[illegible]}{[illegible]} + \frac{[illegible]}{[illegible]} + \frac{[illegible]}{[illegible]}\right] \frac{1}{[illegible]} + \frac{[illegible]}{[illegible]} + \frac{[illegible]}{[illegible]} + \frac{[illegible]}{[illegible]}$$

[illegible] > [illegible]

[illegible]

[illegible] $= 1$

[illegible] $= 1$

[illegible]

[illegible] $= 1$

[illegible]

[illegible] $= 1$

[illegible]

[illegible]

2 ome. [illegible]

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$$

$$\frac{x^2}{a_1^2}+\frac{y^2}{b_1^2}+\frac{z^2}{c_1^2}=1$$

$$x^2\left[\frac{1}{a^2}-\frac{1}{a_1^2}\right]+y^2\left[\frac{1}{b^2}-\frac{1}{b_1^2}\right]+z^2[\;]=0$$

[illegible]

$f=0$

$f'=0$

$f-\lambda f'=0$ [illegible]

[illegible]

[illegible]

[illegible]

$$\frac{x^2}{r^2}+\frac{y^2}{r^2}+\frac{z^2}{r^2}=1$$

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}+\frac{z^2}{c^2}=1$$

$$x^2\left[\frac{1}{a^2}-\frac{1}{r^2}\right]+y^2\left[\frac{1}{b^2}-\frac{1}{r^2}\right]+z^2\left[\frac{1}{c^2}-\frac{1}{r^2}\right]=0$$

[illegible]

[illegible]

[illegible] $r=b$ $\quad x^2\left[\frac{1}{a^2}-\frac{1}{b^2}\right]+z^2\left[\frac{1}{c^2}-\frac{1}{b^2}\right]=0$

1/5 15/4 28/2 18/2